HUMAN FACTORS ANALYSES OF A FALL AND DROWNING IN A RIVER AT FALLS PARK, SIOUX FALLS, SOUTH DAKOTA

Jayne v City of Sioux Falls

United States District Court, District of South Dakota, Southern Division, Case No. 18-4088

Submitted to:
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1. INTRODUCTION

This is a report of human factors analyses of a fall and drowning in Big Sioux River at Falls Park, Sioux Falls, South Dakota. The incident occurred when Maggie Zaiger, a five-year-old girl, visited Falls Park with her mother, Courtney Jayne, and other family members and friends on March 18, 2018. Maggie and some of the other children in her party walked to the river's edge. At some point, Maggie fell off the edge of the river into the water below and subsequently drowned. Plaintiff's expert, Joellen Gill, wrote a report opining about the nature of the hazard that contributed to Maggie's fall and drowning, the adequacy of the fencing and warnings at Falls Park, the adequacy of the supervision of Maggie by her mother, and other issues. My report addresses these issues, and serves as a rebuttal to claims made by Ms. Gill.

This report is based upon facts of my own personal knowledge, or from facts discerned from documents that are available to me and maintained as business records, or from expertise obtained from over 28 years as an experimental psychologist and human factors engineer. This report and its opinions or conclusions are final to a reasonable degree of scientific certainty based on my examination of information provided to date. My conclusions or recommendations are intended for use in actual or potential litigation and are not to be used for other purposes. I reserve the right to amend this report if other information or evidence becomes available.

This report is written at the request of James E. Moore, Esq., attorney for the defendant.

2. QUALIFICATIONS

My *Curriculum Vitae*; including my qualifications and list of publications for the previous ten years, is attached as Exhibit A. A list of cases in which I have testified during the previous four years is attached as Exhibit B.

My qualifications as an experimental psychologist and human factors engineer include:

- Ph.D., Experimental Psychology, University of California, Santa Cruz
- CPE, Certified Professional Ergonomist, Board of Certification in Professional Ergonomics
- OSHA authorized to teach 10-hour and 30-hour courses in general industry safety (including hazard analyses, walking-working surfaces, and hazard communications)
- CXLT, Certified XL Tribometrist, International Safety Academy
- Author of over 60 technical reports and peer-reviewed articles related to experimental psychology, human factors engineering, and ergonomics, including numerous peer-reviewed articles related to falls and to warnings and instructions, including two review articles that addressed fall incidents and walkway safety standards:
    1. Nemire, K. & Cohen, H. H. (2014). Slip, trip and fall issues in forensic human factors. In K. Nemire, J. Cohen & H. H. Cohen (Eds.), *Guide to Forensic Human Factors*. Santa Monica, CA: HFES.

2. Nemire, K., Johnson, D.A. & Vidal, K. (2016). The science behind codes and standards for safe walkways: Changes in level, stairways, stair handrails and slip resistance. *Applied Ergonomics, 52,* 309-316.

My training and experience include the psychology and mechanics of human walking, gait, and falls. This training and experience includes earning a Ph.D. in experimental psychology, which involves study of human information processing. Human information processing is comprised of sensation (e.g., detecting something in the environment), perception (e.g., identifying that "something" as a hazard), decision making (e.g., deciding what to do about the hazard), response selection (e.g., selecting an appropriate response to deal with the hazard), and response execution (e.g., such as adjusting gait to deal with an expected hazard). Some of these processes are non-conscious, and response selection and execution cannot occur if a hazard is not first sensed or perceived. In addition to my doctoral studies, my postdoctoral research involved visuospatial perception and orientation for control of posture and movement, which is critical for the control of gait. In addition, I have written numerous papers about the psychology and mechanics of human walking and falling. This training and experience are helpful in understanding the mechanism of Maggie's fall, the perceptual and cognitive processing needed to recognize fall hazards in the environment, as well as the supervisory control needed by parents to monitor young children.

Human factors is concerned with discovering and applying information about human behavior, abilities, and limitations to the design of tools, tasks, jobs, and environments for safe and effective human use, and includes the study and application of systems to protect people from hazards. My training and experience in experimental psychology relates to *discovering* information about human behavior, abilities, and limitations, and my 28 years as a human factors engineering consultant relates to *applying* information about human behavior, abilities, and limitations to the design of tools, tasks, jobs, and environments for safe and effective human use. In addition, I am a board certified Professional Ergonomist (synonymous with human factors), a Certified XL Tribometrist (relevant to measuring the slip resistance of walkways), and am OSHA authorized to teach 10-hour and 30-hour courses in general industry safety, which includes hazard analyses, walking and working surfaces, and hazard communications.

Experimental psychology and human factors engineering also addresses the creation and evaluation of warnings and warning systems, based on the understanding of human information processing. Effective warnings enable warning recipients to better protect themselves by providing appropriate and sufficient information about hazards so that the warnings will most likely be noticed, read, understood, and followed. I have been involved in numerous projects concerning research, development and/or evaluation of warnings, and have published many papers in peer-reviewed journals about some of this work. The nature of effective versus ineffective warnings and warning systems applies across environments, including the natural and urban park environment at Falls Park.

Pursuant to the applicable provisions of the Federal Rules of Civil Procedure and Federal Rules of Evidence, I hereby affirm, under penalties of perjury that the statements contained herein are true and accurate. The opinions expressed in this report are to a reasonable degree of scientific, technical, and human factors engineering certainty, and based on reliable and generally accepted scientific and human factors engineering techniques. As discovery progresses, I will review pertinent records and material and may form additional opinions that I may also express at the trial.

My compensation is $450.00 per hour for all time spent on a case, including time providing testimony at deposition and trial.

3. MATERIALS REVIEWED

Materials provided by defendant's counsel:

1. City of Sioux Falls Police Department, Draft Report, Case PD18-021227 (CITY 001-9, 9pp)(hereafter "Police report")
2. Sioux Falls Fire Rescue, Incident Report 2018-1805583 (CITY 010-16, 7pp)
3. Expert report, Joellen Gill, dated 4/25/19 (hereafter "Gill")
4. City's Document Production, Supplemental Initial Disclosure
5. City's Document Production, Second Supplemental Initial Disclosure
6. City's Rule 26 Initial Disclosure Documents
7. City's Rule 26(a) Initial Disclosures
8. City's Second Supplemental Initial Disclosure
9. City's Supplemental Initial Disclosure
10. City's Responses to Plaintiff's Interrogatories
11. Falls Park Assets--Attachment to City's Interrogatory Responses
12. Deposition of Judith Payne, 2/19/19
13. Deposition of Kristina Peterson, 2/19/19
14. Deposition of Paytra Nichols, 2/19/19
15. Deposition of Doug Kirkus, 2/20/19
16. Deposition of David Fischer, 2/21/19 (hereafter "Fischer")
17. Deposition of Don Kearney, 2/21/19
18. Deposition of Kelby Mieras, 2/21/19 (hereafter "Mieras")
19. Deposition of Ben Statema, 4/30/19
20. Deposition of Brad Goodroad, 4/30/19
21. Deposition of Jim Sideras, 4/30/19
22. Deposition of Tim Bakke, 4/30/19 (hereafter "Bakke")
23. Deposition of Mike Huether, 5/1/19
24. Deposition of Mary Beth Martinez, 3/7/19
25. Deposition Exhibits 1-36

Research materials:

1. Interview, Kelby Mieras, 6/11/19 (hereafter "Mieras interview")
2. Interview, Timothy Bakke, 6/11/19 (hereafter "Bakke interview")
3. ANSI Z535.1 (2011). *American National Standard for Safety Colors*. New York: American National Standards Institute.
4. ANSI Z535.2 (2011). *American National Standard for Environmental and Facility Safety Signs*. New York: American National Standards Institute.
5. Klinski, M. (2018). Timeline: 10 deaths and dozens of rescues at Falls Park since 1980. *Argus Leader,* 3/21/18. Retrieved from https://www.argusleader.com/story/news/crime/2018/03/20/timeline-10-deaths-and-dozens-rescues-falls-park-since-1980/442785002/.
6. Brown, T. & Beran, M. (2008). In R. Lueder & V.J.B. Rice (Eds.). *Ergonomics for Children: Designing Products and Places for Toddlers to Teens*. New York: Taylor & Francis.
7. Braun, C.C. & Silver, N.C. (1995). Interaction of signal word and colour on warning labels: Differences in perceived hazard and behavioural compliance. *Ergonomics, 38*(11), 2207-2220.
8. Cinelli, M.E., Patla, A.E., Allard, F. (2009). Behaviour and gaze analyses during a goal-directed locomotor task. *Quarterly Journal of Experimental Psychology, 62*(3), 483-499.

9. Cole, M. & Cole, S. (2001). *The Development of Children* (4th Ed.). New York: Worth Publishers.
10. Eubanks, J.J. (1994). *Pedestrian Accident Construction*. Tucson AZ: Lawyers & Judges Publishing Co.
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12. Gibson, J. J. (1979). *The ecological approach to visual perception*. Boston: Houghton Mifflin.
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14. Hathaway, J. A., & Dingus, T. A. (1992). The effects of compliance cost and specific consequence information on the use of safety equipment. *Accidental Analysis & Prevention, 24*, 577–584.
15. Jaynes, L. S., & Boles, D. B. (1990). The effect of symbols on warning compliance. In *Proceedings of the Human Factors Society 34th Annual Meeting* (pp. 984–987). Santa Monica, CA: Human Factors and Ergonomics Society
16. Laughery, Laughery & Lovell, 1998. Tire-rim mismatch explosions: The role of on-product warnings. *Proceedings of the Human Factors Society 42nd Annual Meeting (pp.* 1088-1092).
17. Mark, L.S. (1987). Eyeheight-scaled information about affordances: A study of sitting and stair climbing. *Journal of Experimental Psychology: Human Perception and Performance, 13*(3), 361-370.
18. Morrongiello, B.A. (2005). Caregiver supervision and child-injury risk: I. Issues in defining and measuring supervision; II. Findings and directions for future research. *Journal of Pediatric Psychology, 30*, 536-552.
19. Nemire, K. (2011). Cognitive human factors in litigation. *Ergonomics in Design, 19* (1), 16-20.
20. Nemire, K. (2013). Multicultural, rapid, collaborative, iterative design and evaluation of a warning pictorial. *Proceedings of the Human Factors and Ergonomics Society 57th Annual Meeting* (pp. 1707-1711).
21. Nemire, K. (2014). The hidden hazard of an invisible flame. *Proceedings of the Human Factors and Ergonomics Society 58th Annual Meeting* (pp. 1869-1873).
22. Nemire, K. (2016). Ratings of the effectiveness of warnings on consumer paint stripper products: Evaluation by university students and MTurk workers of FHSA- and ANSI Z535.4-formatted warning labels. *Proceedings of the Human Factors and Ergonomics Society 60th Annual Meeting* (pp. 480-484).
23. Nemire, K. (2019). Warning signs to fasten seat belts result in higher rates of rear seat belt use in rideshare vehicles. *Proceedings of the Human Factors and Ergonomics Society 63rd Annual Meeting* (in press).
24. MacLellan, M.J. & Patla, A.E. (2006). Adaptations of walking pattern on a compliant surface to regulate dynamic stability. *Experimental Brain Research, 173*, 521-530.
25. Marigold, D.D. & Patla, A.E. (2008). Age-related changes in gait for multi-surface terrain. *Gait & Posture, 27*, 689–696.
26. Otsubo, S. M. (1988). A behavioral study of warning labels for consumer products: Perceived danger and use of pictographs. *In Proceedings of the Human Factors Society 32nd Annual Meeting* (pp. 536–540). Santa Monica, CA: Human Factors and Ergonomics Society.
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31. Shaver, E.E. & Braun, C.C. (2000). Effects of warning symbol explicitness and warning color on behavioral compliance. In *Proceedings of the IEA 2000/HFES 2000 Congress* (pp. 4-290-4-293).
32. Thyer & Geller 1987. The buckle up dashboard sticker: An effective environmental intervention for safety belt promotion. *Environment and Behavior, 19*, 484-494.
33. Warren W.H. (1984). Perceiving affordances: Visual guidance of stair climbing. *Journal of Experimental Psychology: Human Perception and Performance, 10*(5), 683-703.
34. Warren, W.H. & Whang, S. (1987). Visual guidance of walking through apertures: Body-scaled information for affordances, Journal *of Experimental Psychology: Human Perception and Performance, 13*(3), 371-383.
35. Wogalter, M.S. (Ed.) (2006). *Handbook of Warnings*. New Jersey: LEA Publishers.
36. Wogalter, M. S., & Barlow, T. (1990). Injury severity and likelihood in warnings. In *Proceedings of the Human Factors Society 34th Annual Meeting* (pp. 580–583). Santa Monica, CA: Human Factors and Ergonomics Society.
37. Wogalter, M.S., Conzola, V.C., & Smith-Jackson, T.L. (2002). Research-based guidelines for warning design and evaluation. *Applied Ergonomics 33*, 219–230.
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39. Wogalter, M.S., Kalsher, M.J., & Racicot, B.M. (1992). The influence of location and pictorials on behavior compliance to warnings. *Proceedings of the Human Factors and Ergonomics Society, 36,* 1029–1033.
40. Young, S. (1991). Increasing the noticeability of warnings: Effects of pictorial, color, signal icon and border. *Proceedings of the Human Factors and Ergonomics Society 35th Annual Meeting* (pp. 580-584)
41. Young, S.L. & Wogalter, M.S. (1990). Comprehension and memory on instructional manual warnings: Conspicuous print and pictorial icons. *Human Factors, 32*, 637-649.

4. SITE INSPECTION

I conducted a site inspection on June 11, 2019. During the site inspection, I was accompanied part of the time by Melanie Carpenter, attorney for defendant; Kelby Mieras, Park Operations Manager; and Detective Timothy Bakke, City of Sioux Falls Police Department. During the site inspection I made measurements and photographs described below, and interviewed Mr. Mieras and Detective Bakke.

5. EXHIBITS

Exhibits for deposition and trial will include the exhibits at the end of this report, as well as the materials listed in Section 3 above.

6. INCIDENT SCENARIO

According to various statements provided in the police report, Maggie Zaiger, a five-year-old girl, visited Falls Park with her mother, Courtney Jayne, and other family members and friends on March 18, 2018. The party arrived at the park and went immediately to the top of the observation tower next to the visitor center. At some point, they noticed a large pile of foam on the river, then descended the tower and walked

to the section of river where they had noticed the foam. Exhibit C shows the probable route the party took to the observation tower and to the river. Maggie and some of the other children in her party walked to the river's edge to touch and play with the foam. After 14-year-old friend Jeremy played with the foam, Maggie also reached out to touch the foam. As she reached for the foam, Maggie fell off the edge of the river into the water below and subsequently drowned. The 911 call log showed that the first call reporting Maggie's fall was made at 12 noon.

Ms. Jayne and Crissy Melendez were the only two adults in the party, which also included five children aged 4 to 14 years. At the time of Maggie's fall, the adults stated that they were about 10-15 ft away from the location where Maggie fell. About two minutes before Maggie's fall, Ms. Melendez took photos of Jeremy and the other two older children (about 11 and 12 years old) near the river's edge (Exh. D, E). These photographs depict the approximate area from where Maggie fell, and the foam piled on the river.

7. DESCRIPTION OF HAZARD

A hazard is "a condition or set of circumstances that has the potential of causing or contributing to injury or death" (Sanders & McCormick, 1993, p. 675). To determine the hazards relevant to the subject fall and drowning of Maggie Zaiger, I conducted some preliminary hazard analyses. A good hazard analysis will identify hazards in a system, such as Falls Park, and lead to recommendations for how to eliminate or mitigate the hazards. A critical part of a hazard analysis includes analyses of previous accidents and near miss accidents (Hagan, Montgomery, & O'Reilly, 2009). While Ms. Gill mentioned 10 drownings that have occurred at Falls Park since 1980, she failed to analyze the causes of those deaths, or the causes of the 32 rescues (near misses) that had occurred in the Park during the same time period. A complete and thorough analysis of deaths and near misses at Falls Park is beyond the scope of this report. However, an analysis of the descriptions of 42 drownings and rescues since 1980 provided in the local newspaper (Klinski, 2018) can be informative. Of the 42 incidents described in the article, 21 (50%) occurred as a result of wading or jumping or canoeing in the river, 8 (19%) were a result of a fall into the river, 3 (7%) involved rescuers (including the two teens who died attempting to rescue a younger child in 2013), and 10 (24%) were of unknown cause (with alcohol intoxication suspected in one of these incidents). Only four (10%) of these incidents, including the subject incident, occurred in February or March, when the foam builds up on parts of the river (Mieras interview). The newspaper article only mentioned foam in an event description 1 time (2%), when describing the subject fall and drowning. Furthermore, these fatalities and near misses were spread along the river, with no obvious site responsible for more incidents than another. Analyses of these 42 incidents indicate that 69% resulted from visitors playing in the water or falling into the water; the rest involved rescuers or were of unknown cause. Most of the incidents involved entering the river and falls from height. The presence of foam did not appear to be a causal factor in most of the drowning and rescue incidents.

Another critical part of a hazard analysis is to examine features of a system, such as Falls Park, to identify hazards (Hagan et al., 2009). I conducted such an examination during my site visit. Detective Bakke identified the area of the rocky ledge from which Maggie fell based upon his memories from the day of the incident and photographs taken the same day (Exh. D, E, F). Inspection of the area confirmed that the height of the rocky walls above the river presented a fall hazard (during my visit, the walls extended about seven feet above the river), and that the depth and flow of the river presented a drowning hazard. In addition, I also noted that the uneven surface of the exposed tops of the rock walls presented trip hazards (Exh. D, E, F).

The hazards in the subject incident scenario were the uneven rocky surface at the top of the canyon wall that posed a trip hazard, the top of the rocky canyon wall located approximately seven feet above the river that posed a fall hazard, and the deep and turbulent river below that posed a drowning hazard.

8. ANALYSES

Ms. Gill, in her expert report, described the following opinions:

1. The foam on the river constituted a hazard
2. Defendant failed to adequately guard and warn of the subject hazardous area
3. Defendant failed to adequately design the warning signs installed at Falls Park
4. Maggie's mother adequately supervised Maggie

Each of Ms. Gill's opinions will be addressed below.

1. Ms. Gill Opinion #1: The foam on the river constituted a hazard.

a. Ms. Gill recognized that the fast, deep river constituted a hazard (Gill p. 4), but also claimed that the foam constituted a hazard because it had a tendency to lull visitors into a false sense of security (Gill pp. 4, 11) and may camouflage the edge of the river (Gill p. 5).

b. Regarding the issue that the foam posed a hazard because it created a "false sense of security", Ms. Gill only cited speculation from a newspaper article (Gill p. 4). Perhaps related to this issue, is Ms. Gill's claim that the foam acted as an attractant to children (Gill p. 6). However, besides the statements indicating that both children in the 2013 and 2018 incident were playing with foam, Ms. Gill provided no evidence that the foam was hazardous because it acts to attract children to the rocky canyon wall above the river. Besides these two incidents, there is no indication that the foam was particularly attractive to children. For example, Mr. Mieras stated that in all his time with Falls Park, the only time he has seen or heard of children playing with the foam was the 2018 incident (Mieras p. 52). It also should be noted that the two children in the 2013 and 2018 incidents were 6 and 5 years old, respectively. As noted below, young children need to be supervised in natural environments. The undeveloped cognitive abilities of young children do not allow them to perceive the hazards of being at the top of a canyon wall above a river. This is true, whether foam is present or not.

c. As evidence that the foam constituted a hazard, Ms. Gill cited various statements that the foam on the river piled up as far as the top of the canyon wall during a previous 2013 drowning incident and the canyon edge was difficult to see because of the foam (Gill p. 8). She also cited deposition testimony from Mr. Fischer, Mr. Mieras, and Mr. Hall indicating that the foam could obscure the edge of the river and could pose a hazard (Gill pp. 8, 9), and testimony from Mr. Mieras, Mr. Kearney, and Mr. Hall indicating that they did NOT consider foam to be a hazard at the park (Gill pp. 9-10).

d. Ms. Gill presented no clear evidence that the foam presented a hazard at Falls Park by camouflaging the roc. Part of the problem with Ms. Gill's cherry-picking evidence to support her view that foam obscured the edge of the river and constituted a fall hazard at Falls Park related to misinterpretations of deposition testimony and other documents. For example, careful reading of Mr. Fischer's testimony shows that he agreed the foam was a hazard if it covered the ground below and one could not see the distance one could fall from the top of the canyon wall (Fischer pp. 38-39). He also noted that he has never seen the foam piled up higher than the west bank of the river where Maggie fell (Fischer p. 44)

e. The presence of the foam did not constitute a hazard independent of that provided by the rocky edge at the top of the canyon wall. Photos from Ms. Melendez indicate that the top of the foam near the subject rocky ledge piled up near the top of the canyon wall, but did not obscure the top of the canyon wall (Exh. D, E, G). While the foam obstructed view of the lower canyon rock ledges, including where Maggie was standing before she fell, as well as the river below (Bakke pp. 21, 22, 28, 29), they did not obstruct view of the top of the canyon wall (Bakke interview).

f. In addition, in contrast with Ms. Gill's opinion about the foam, the foam provided visual cues to the location of the cliff and river hazards, rather than a hazard itself. The foam was an indicator of where the river was located, and therefore where not to walk. The foam provided visual indicators contrary to "affordance" for safe travel. The term "affordance" is used to describe how the surface features of an object or environment specifies actions that one can take (or not take) with that object or in that environment (Gibson, 1979). Affordances are relational properties of the user and of the object or environment. Research has shown that people make decisions about how to interact with the environment based on body-scaled factors such as eye height and leg length, and the visual features of the environment. Examples of decisions about interactive strategies based on body-scaled factors include whether a stair is too steep to climb (Warren, 1984; Mark 1987), whether a person will fit through gaps such as doorways without turning sideways (Warren & Whang, 1987), whether something can be sat upon (Mark, 1987), or whether a person needs to change speed to pass through a sliding door (Cinelli, Patla, & Allard, 2009). Similarly, people can perceive textural differences in a walking surface that indicates whether the surface presents a hard, rigid, and stable surface for safe walking (MacLellan & Patla, 2006; Marigold & Patla, 2008). Furthermore, note that this research shows that if the visual features of an environment specify a potentially adverse outcome, people will take actions to avoid harm, such as by turning sideways to fit through an aperture (Warren & Whang, 1987) or to slow down to avoid colliding with a sliding door (Cinelli et al., 2009), or to change gait when presented with a soft, pliable, unstable walking surface (MacLellan & Patla, 2006; Marigold & Patla, 2008). The foam not only indicated the location of the fall and drowning hazard, but also indicated that it was not sufficiently dense to safely on.

g. Because of the perceptual cues provided along the jagged, rocky canyon wall above the river (Exh. H, I, J), it would be expected, by an attentive and reasonable visitor, that the rock ledge at which Maggie was standing would be jagged and at some height above the river. From the perspective of Ms. Jayne and Ms. Melendez, about 10-15 feet from the river (or farther, see below), the specific edge of the river, where Maggie was approaching and standing, could not be determined (Exh. E). Detective Bakke indicated that foam had obscured the ledge where Maggie was standing, but not the top of the canyon wall (Bakke pp. 21, 22, 28, 29; Bakke interview). This indicates that Maggie was standing on a lower rock ledge, similar to where the two girls were standing when Ms. Melendez took her photograph (Exh. E). If foam had obstructed view of the rocky ledge where Maggie and the two girls were standing, it would have provided no less visual information about the location of the canyon edge than the actual top ledge of the canyon wall itself. The foam did not constitute a hazard separate from that of the top of the canyon wall above the river.

h. Furthermore, there has been an implied claim that it would have been safe for Maggie to step on the piled up foam, whether perceived as foam or as snow. Neither could be considered safe. Visual cues to walkway density alter how people walk on a walkway (MacLellan & Patla, 2006; Marigold & Patla, 2008). There were visual cues provided by the foam that would indicate it was less dense than the rock (Exh. D, E, F, G), and there

were perceptual cues that indicated that the foam was on top of the river (Exh. D, E, F, G). Given that the incident occurred in March, and there were only a few patches of what might have been snow on the ground elsewhere (Exh. K), an attentive and reasonable person would most likely not surmise that the pile of soft white stuff on the river was snow, and there should have been no expectation that foam or other soft material piled on top of the river would support body weight. Stepping on the foam at the edge of the river would have constituted a risky act.

i. One of the main purposes of warnings is to inform users about the presence of a hazard of which they may not be aware (Sanders & McCormick, 1993, p. 681). Since the subject fall and drowning hazard was not hidden, and provided sufficient perceptual cues to sighted and reasonable people to indicate the hazard of approaching or standing on the top of the canyon wall above the river, there was no need for any warning about the subject fall and drowning hazards.

2. Ms. Gill Opinion #2: Defendant failed to adequately guard and warn of the subject hazardous area.

a. Ms. Gill opined that Defendant should have provided fencing to guard visitors of the fall and drowning hazards, and should have installed better warnings to warn of the hazards, including the claimed hazard of the foam.

b. As part of my hazard analyses, I noted that most of the river's natural features in this area have been preserved--it essentially remains a swiftly flowing natural river through rocky canyon walls. While the portion of the river within Falls Park is surrounded by the sidewalks and tended green lawns of an urban park, the river itself has retained most of its characteristics as a natural environment, with all the attendant hazards and unpredictability of a natural, not urban, environment. As a result of this examination of the natural canyon and river environment, I noted that the fall hazard posed by the rock walls above the river, and the drowning hazard presented by the deep and turbulent river should have been readily apparent (open and obvious) to an attentive and reasonable person, based upon depth, distance, motion and textural cues provided by the rocky surface at the top of the canyon wall, the perceived distance across the river, the perceived height of the rocky canyon wall above the portion of the river not covered in foam, and the perceived motion and texture of the water moving in the river. (Exh. H, I, J, L, M, N; Sedgwick, 1986).

c. Since Maggie's party had ascended the observation tower (Police report), it is most likely they would have viewed the water falls during that viewing, and the perceptual features noted earlier-- indicating tall canyon walls and a swiftly moving river--would have been available to reasonably attentive visitors (Exh. H, I, J). After the party descended the observation tower and walked to the subject incident area, these perceptual cues also were available from the area from which Ms. Melendez and Ms. Jayne were standing when the photos of the three children were taken (Exh. L, M, N). These perceptual cues, as well as their previous experience walking on the rocky terrain to the river's edge, and previous experience with other natural environments such as rivers and cliffs, would indicate that the rocky top of the canyon wall could be slippery, has a jagged and not straight boundary, that it can be difficult to determine the exact location of the top of the canyon wall, and that the top of the canyon wall posed a fall hazard to the rushing river below.

d. It is generally recognized that visitors to natural environments that include hazards such as cliffs and swiftly moving rivers do not need to be guarded from the obvious hazard or warned of the obvious hazard (Exh. O, P; Wogalter, 2006). Given that the subject fall and drowning hazard was in a natural area, and would have been expected and readily apparent

(open and obvious) to reasonable and prudent visitors, there was no need to guard or warn visitors of those hazards (Sanders & McCormick, 1993, p. 681; Wogalter, 2006).

3. Ms. Gill Opinion #3: Defendant failed to adequately design the warning signs installed at Falls Park.

a. Ms. Gill claimed the warning signs installed at various locations around Falls Park (Exh. Q) were inadequate because they failed to warn about the hazard of the foam (Gill p. 4). As indicated earlier, there was no need to warn about the foam because it did not constitute a hazard independently of the open and obvious subject fall and drowning hazard.

b. Ms. Gill also claimed that one of the hazards posed by the foam was to make the rocks slippery, and that there should be a separate warning regarding the foam (Gill p. 6). During the site inspection, I measured the slip resistance of representative horizontal rock faces at the edge of the canyon wall. Measurements indicated that the presence of the foam decreased the slip resistance of the rocks (.4) compared to dry rocks (.66) and rocks wetted only by river water (.56). A slip resistance of 0.5 or greater is considered safer to walk on. While the foam made the rocks more slippery, the existing signs already warn about the hazards of slippery rocks; that is sufficient, whether the cause of the slipperiness is water, foam, or debris left by other visitors.

c. Ms. Gill also claimed that the foam acted to attract children to the river's edge to interact with the foam (Gill pp.4, 11). However, Ms. Gill failed to provide any evidence that the foam provided a particularly hazardous attractant. There are many attractants along the Big Sioux River, including the water falls: Visitors may want to reach out to feel the force of the water on their hands, fishermen and women may reach out over the river to pull in a hooked fish, visitors may want to reach out over the river to feed and attract the large fish readily observed jumping out of the river. There are many attractants; however, the open and obvious nature of the subject fall and drowning hazards serve sufficient warnings about the hazards of reaching over a river, and specific warning about each of these attractants is not necessary.

d. Ms. Gill also implied that a subject warning sign was not located along the route taken by the party (Gill p. 6). However, along the route most likely taken by the party when walking from the parking lot to the observation tower (Exh. C), there was a warning sign (Exh. Q). As indicated below, this warning sign most likely would have been noticed by most attentive and reasonable visitors walking by it.

e. Ms. Gill also implied that the subject Falls Park warning sign (Exh. Q) was inadequate because it was not designed by "trained professionals" (Gill p. 11). She also stated that the warning sign was not in accordance with the ANSI Z535 standards because the sign failed to warn of the hazards presented by the foam (Gill p. 11). As indicated in Section 8.1 and 8.2 of this report, there was no need to provide separate warnings about the foam, because the foam did not constitute a hazard. The existing warning sign, while apparently not designed by hazard communication experts, was comprised of the elements of an effective warning sign. The individual features of the existing warning sign will be discussed below:

f. First, the very presence of the existing warning sign at Falls Park would most likely reduce risk for park visitors. Presence, versus absence, of an effective warning helps users reduce risk associated with a hazard (Ferrari & Chan, 1991; Hathaway & Dingus, 1992; Jaynes & Boles, 1990; Laughery, Laughery & Lovell, 1998; Shaver & Braun, 2000; Thyer & Geller, 1987; Wogalter & Barlow, 1990; Wogalter et al., 1987).

g. Second, human factors research has shown that the components of an effective warning include the following (Rogers et al., 2000; Wogalter et al., 2002):

i. **Effective signal word**. A warning should include a signal word that is appropriate to the hazard, such as DANGER, WARNING, or CAUTION. Empirical research has consistently indicated the importance of using a signal word, and use of signal words in warning signs are specified in ANSI Z535.2-2011 *American National Standard for Environmental Facility and Safety Signs*, that was in effect when the signs were installed at Falls Park. Similarly, empirical research, and ANSI Z535.1 *American National Standard for Safety Colors*, specify use of red, orange, or yellow in warning signs to help users notice, read, understand, and follow warnings. While the existing sign used the older format for signal word and colored background (Exh. R), use of the older format would not make the subject sign less effective. What is most critical is the signal word in capital letters and sufficient visual contrast of the orange letters with the black background (Braun & Silver, 1995; Wogalter et al., 1987; Young, 1991). The signal word and its background color used in the subject warning sign would have been sufficient to warn visitors.

ii. **Effective symbols.** Warnings with text, as well as symbols, are more easily noticed, understood and complied with than warnings without symbols (Otsubo, 1988; Wogalter, Kalsher, & Racicot, 1992; Young, 1991; Young & Wogalter, 1990). The four symbols used in the subject warning sign follow basic design guidelines for symbols, such as clear figure-ground contrast, simplicity, and boldness (Wogalter, 2006), and the prohibition symbol on the "No Swimming" symbol is appropriately used. Based on my experience designing and evaluating warnings (e.g., Nemire, 2011; 2013; 2014; 2016; 2019), the symbols on the subject warning sign would more likely than not be effective in warning visitors of their represented hazards.

iii. **Description of hazard**. A warning should describe the nature of the hazard. The subject warning sign describes the fall and drowning hazard in the "Slippery Rocks" and "Turbulent Water" symbols and their accompanying text. The description statements are clear and simple, and most likely would be effective in warning visitors of the fall and drowning hazards.

iv. **Instructions for how to comply with the warning**. A warning should indicate what the user should or should not do to avoid the hazard. Instructions for how to avoid the "Slippery Rocks" hazard are provided in the text below the symbols: "...keep (children) a safe distance from the water's edge". A better instruction might have been "Keep Off Rocks" or "Stay Back From Rock Edge". However, these instructions are implied in the warning; it is commonly understand that if rocks are slippery, the safer course of action would be to avoid the rocks. Research has shown that implied instructions are as effective explicit instructions (Wogalter et al., 1987). The instructions for the "Turbulent Water" hazard are implied in the pictorial, as well as explicitly stated in the "No Swimming" pictorial. In addition, the "Supervise Children" symbol, along with the text warning parents to supervise children, provided clear instructions for how parents could help their children avoid the fall and drowning hazards: "...keep (children) a safe distance from the water's edge". The instruction statements are clear and simple, and most likely would be effective in warning visitors of the fall and drowning hazards.

v. **Consequence of failing to comply with the warning**. A warning should motivate user compliance with the warning, by describing the consequences of not complying with the warning. There are no explicit consequence statements on the warning sign, such as "You could fall and hurt yourself" or "You could drown". However, just as with instruction statements, implied consequences can be as

effective as explicitly described consequences (Wogalter et al., 1987). It is commonly understood that falling from a cliff could cause injury or that entering turbulent water could cause drowning. No explicit consequence statements are needed. The implied consequence statements are clear and simple, and most likely would be effective in warning visitors of the fall and drowning hazards.

h. The existing warning signs at Falls Park would most likely be effective at encouraging visitors to notice, read, understand and comply with the warnings.

4. Ms. Gill Opinion #4: Maggie's mother adequately supervised Maggie

a. Ms. Gill claimed that she saw no evidence that Ms. Jayne failed to adequately monitor Maggie (Gill p. 13). She supported her claim by indicating that Ms. Jayne and Ms. Melendez were no more than 10-15 feet from Maggie when Maggie fell. During the site visit, I used my camera to adjust my view to match the view shown in both photos of the children taken by Ms. Melendez. This exercise indicated that Ms. Melendez was probably standing about 40 feet from the river edge, rather than 10-15 feet. Even at 10 feet, the adults were too far away from a five-year-old child to effectively monitor the child. At age 5 years, girls may walk at an average speed of 4.5 fps and run at 11 fps. Adult females in their 30's may walk a similar pace of 5.4 fps and jog at 11 fps (Eubanks, 1994, pp. 45-48). Given the similar capabilities of the adult and the young child, the adult would be most prudent to stay within easy reach of the five-year-old child to prevent unsafe behavior such as walking near the edge of a river. Consider the subject situation in which Ms. Jayne claimed to have been 10-15 feet away from Maggie, and Maggie was less than a foot from the edge of the canyon wall from where she fell. In the 0.2 second it would take Maggie to step or trip off the canyon wall, Ms. Jayne could only walk about 1 foot and run about 2 feet. Clearly not enough time to prevent an accident. As indicated earlier, the foam provided indication of where the edge of the canyon was located. A more prudent solution would have been to hold Maggie's hand as mother and child walked to the edge of the canyon together.

b. Ms. Gill also noted that the fact that Ms. Jayne took her eyes off Maggie momentarily was not a sign of a supervisory failure. As an example, she used the situation of a teacher with a room full of students, claiming that teachers may divide their attention among students and still adequately supervise them. However, her example is not representative of the subject situation. In her classroom situation, it is presumed that it is a controlled environment with windows and doors and no dangerous materials within easy reach of the children. In contrast, the subject river was essentially a wild and natural river with its rocky walls jutting about seven feet above the river. This was not a controlled environment; consequently, closer supervision of young children by parents was required in the natural environment than in a controlled classroom environment. The cognitive capabilities of five-year-old children are such that they are likely to focus on one thing at a time (Brown & Beran, 2008; Cole & Cole, 2001) such as reaching out to touch foam and forgetting that she is standing at the edge of a canyon, and less likely than older children or adults to be able to recognize hazards (Brown & Beran, 2008; Cole & Cole, 2001). The emotional capabilities of five-year-old children are such that they are learning to enjoy doing things for themselves and other children (not adults) (Brown & Beran, 2008; Cole & Cole, 2001), Consequently, a five-year-old child may venture off by themselves to investigate what other children are doing, such as touching foam piled on a river.

c. Because of these limited capabilities, parents and other responsible adults, must closely monitor young children's behavior to ensure they are safe (Rice & Lueder, 2008); this is

especially true when the children are in a natural, not built, environment, such as the Big Sioux River. One definition of adult supervision to prevent injury in children younger than six years was provided in Morrongiello (2005). Appropriate supervisory behavior consisted of (1) attention (extent of watching and listening), (2) proximity (within vs. beyond arm's reach), and (3) continuity of attention and proximity (e.g., constant/intermittent/not at all). A lapse in any of these supervisory behaviors, such as intermittently attending or typically supervising from a distance more than an (adult's) arm reach leads to higher rate of injuries.

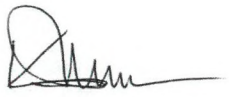
d. During the site visit, I observed groups with young children to determine how closely the accompanying adults monitored the children. I photographed all of the groups with young children that I observed. I was able to observe eight different groups with 26 children along the river. I observed the following:
    i. None of the young children ventured closer to the river edge than about 10 feet (Exh. S) (estimated at the site and using Google Earth aerial photos of the same sites that were photographed). Given my distance from the groups, I could not determine whether the adults used vocal instructions to keep the children close to them and away from the river, or whether the children had already learned to maintain a safe distance from the river.
    ii. All of the children were closely monitored in that at least one adult was no more than a few feet from each younger child (Exh. S).
    iii. Most of the time, there was an adult positioned between the young child and the river (Exh. T).
    iv. Sometimes an adult monitored the action of the younger child by holding the child's hand or carrying the child (Exh. U).
e. Ms. Jayne did not act in a way that would be expected of parental supervision, and did not act to closely monitor her young child as did other parents observed at Falls Park. Ms. Jayne failed to maintain a close distance to her five-year-old child in an obviously hazardous environment. Consequently, Ms. Jayne failed to adequately monitor Maggie.

10. SUMMARY

In summary, my opinions in this case are that:

1. The rocky edge of the canyon walls and the swiftly flowing river presented open and obvious hazards to visitors.
2. The foam on the river did not constitute a hazard separate from the open and obvious hazard of the rocky top of the canyon and flowing river
3. There was no failure of Defendant to adequately guard and warn of the subject hazardous area
4. Defendant's warning sign installed at Falls Park was adequately designed, and most likely was effective at warning of the subject hazards
5. Maggie's mother failed to adequately supervise Maggie

Respectfully submitted,



Kenneth Nemire, Ph.D., CPE
HFE Consulting LLC

EXHIBIT A. CV for Kenneth Nemire, Ph.D., CPE

EXHIBIT B. List of cases in which Dr. Nemire has testified during the previous four years.

EXHIBIT C. Location of Falls Park warning signs (green and red asterisks) and most likely route taken from party to incident site, along sidewalk from parking lot (A) to observation tower (B), to sidewalk junction (C), then across grass and rocks to incident site (D).

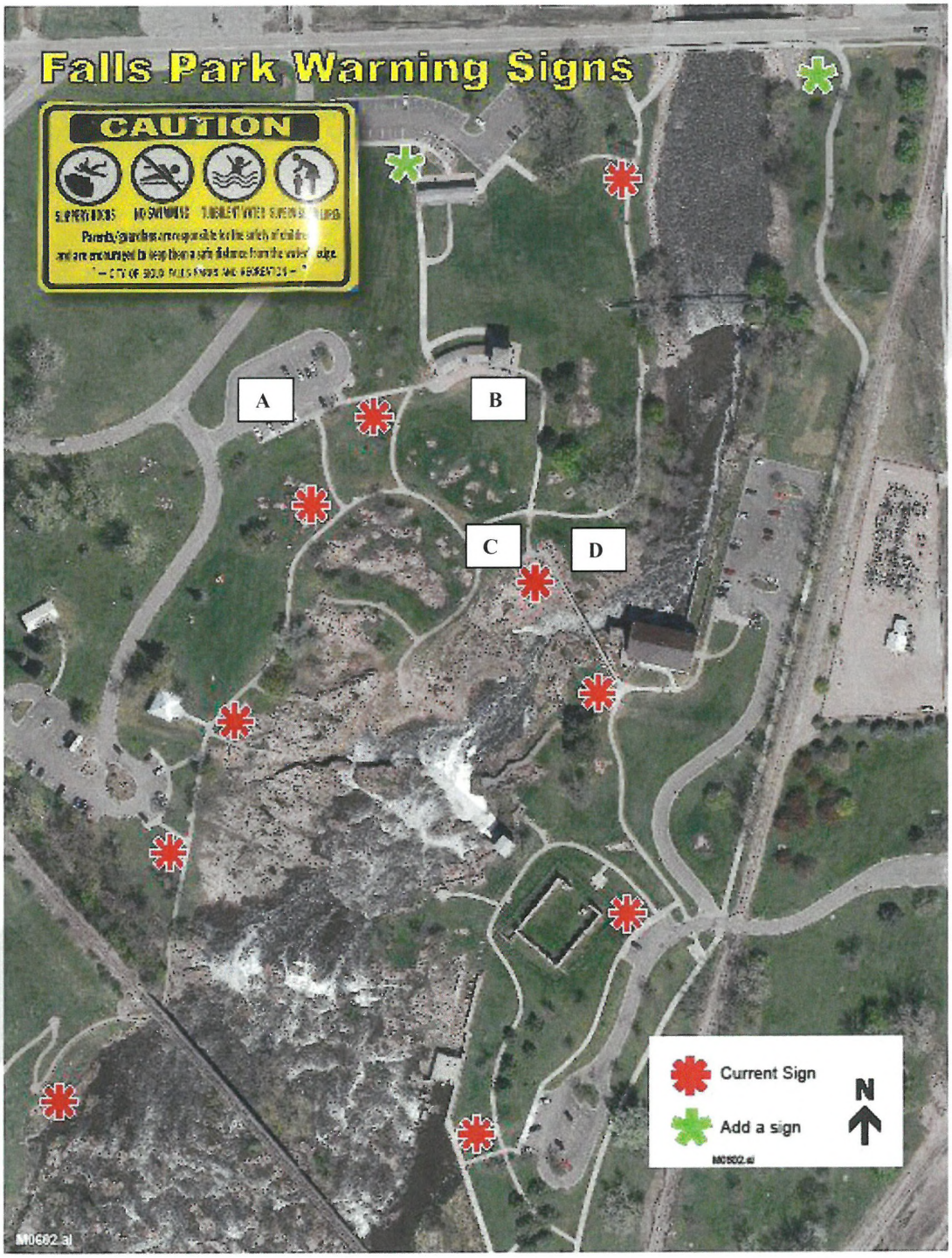


EXHIBIT D. Photograph taken by Ms. Melendez about two minutes before Maggie fell. Note uneven rocky surface at top of canyon wall, and level of foam lower than the top of the canyon wall. Also note that the foam is primarily over the river.

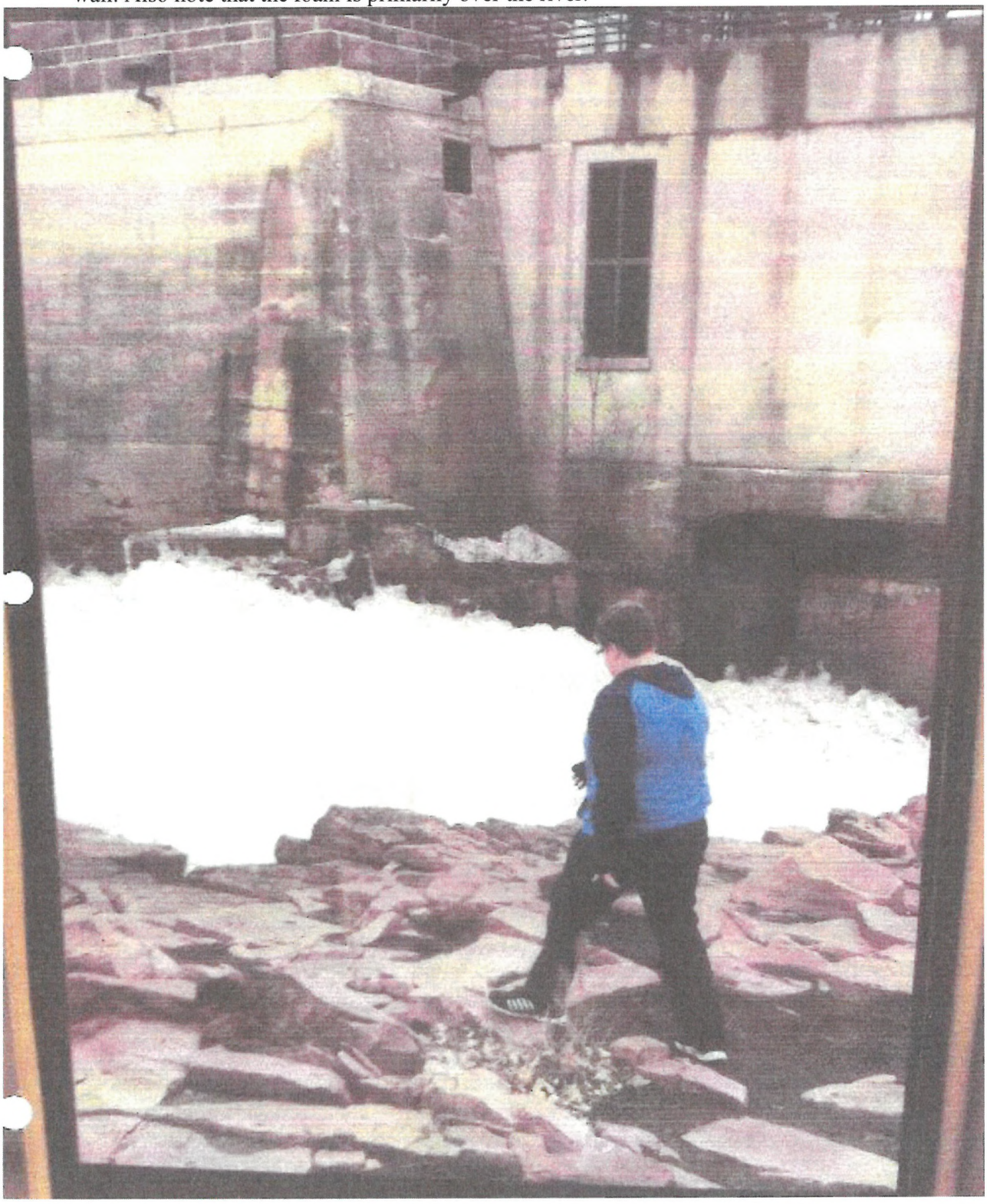


EXHIBIT E. Photograph taken by Ms. Melendez about two minutes before Maggie fell. Note uneven rocky surface at top of canyon wall, and level of foam lower than the top of the canyon wall. Also note that the two girls are standing on a rock ledge below the top of the canyon wall, and that the foam is primarily over the river.

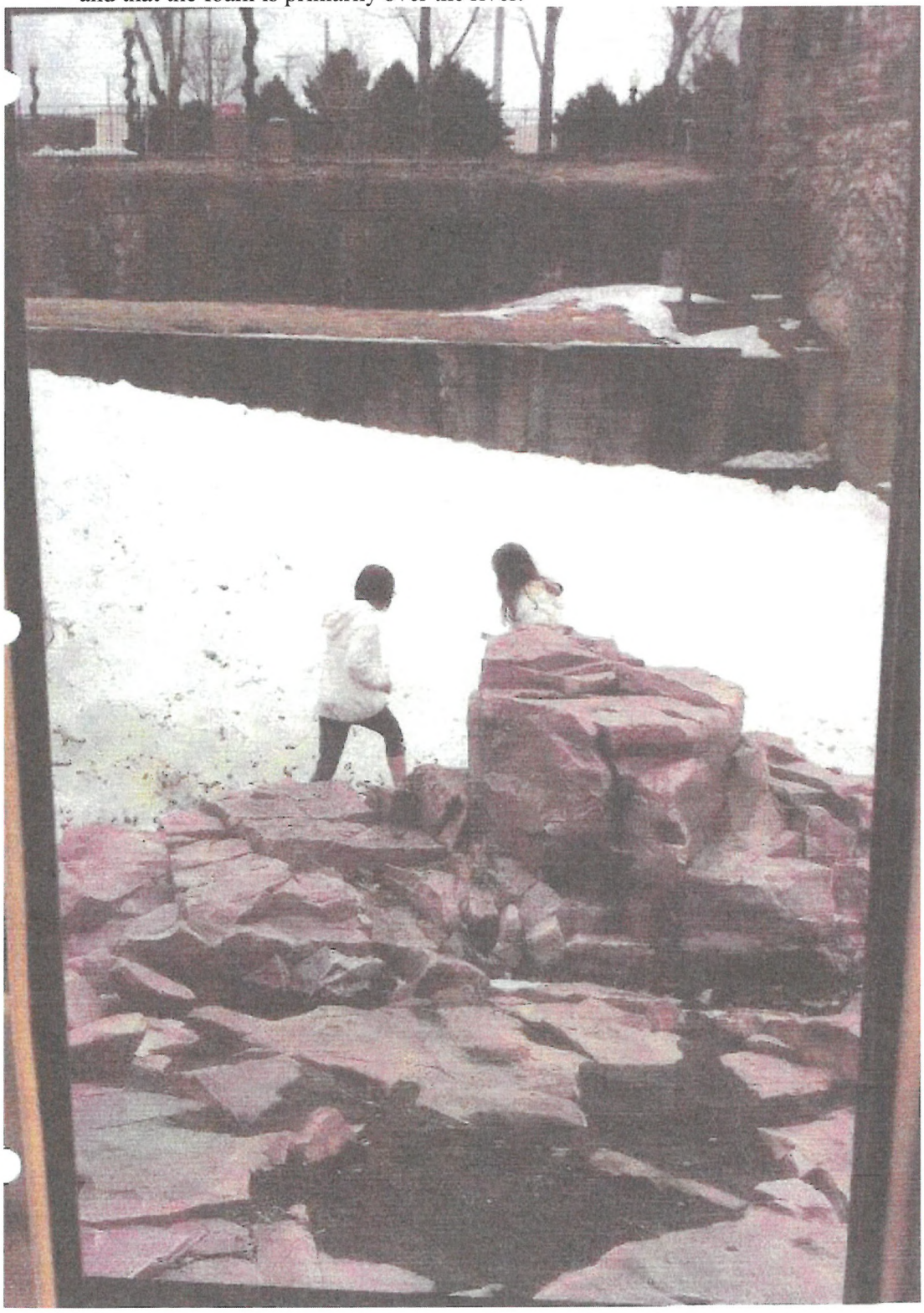


EXHIBIT F. Photograph taken by City police a few hours after Maggie's fall. Note uneven rocky surface at top of canyon wall, and level of foam lower than the top of the canyon wall. Also note that the foam is primarily over the river.

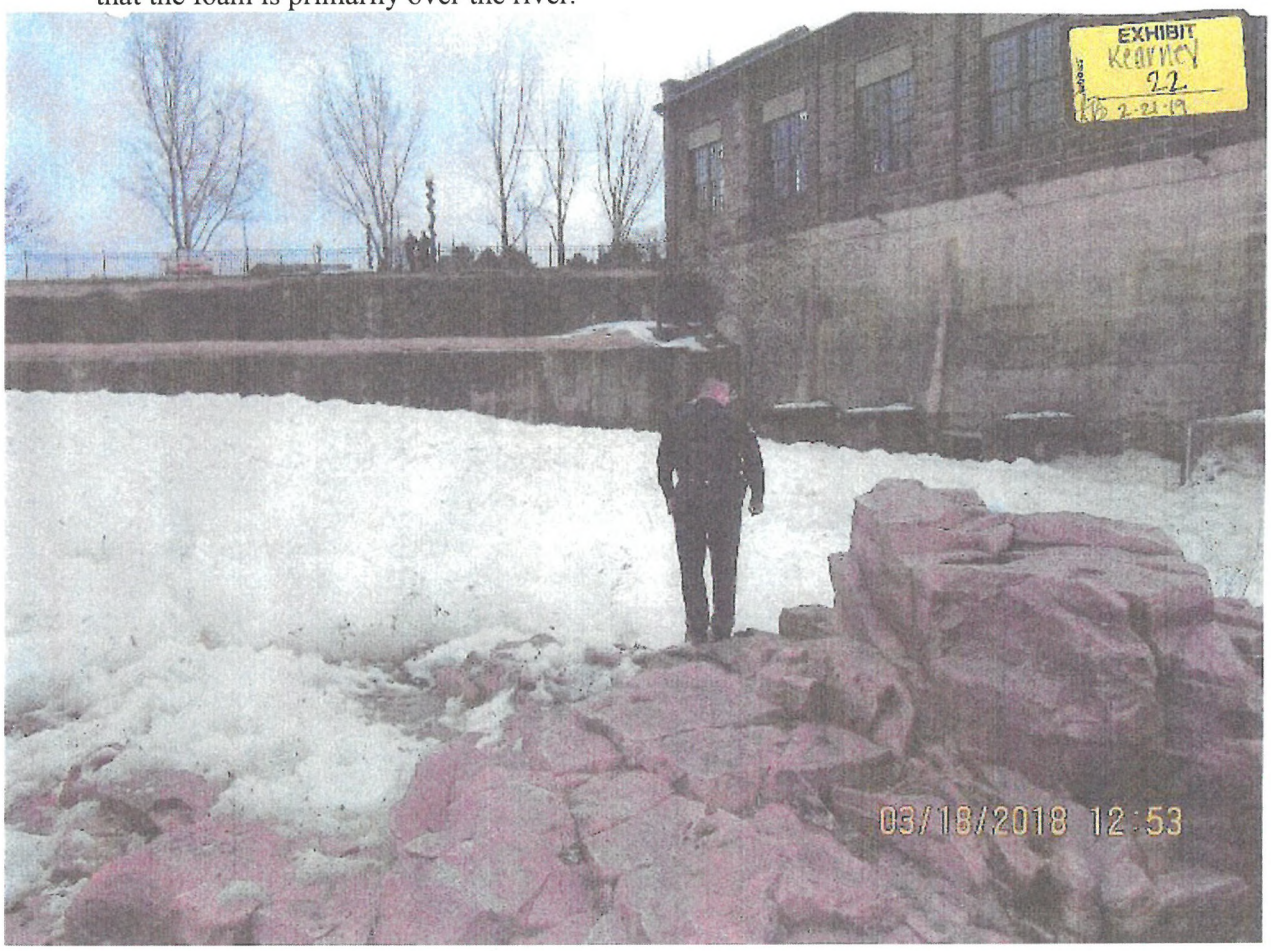


EXHIBIT G. Photograph taken by Ms. Melendez about two minutes before Maggie fell. Note uneven rocky surface at top of canyon wall, and level of foam lower than the top of the canyon wall.

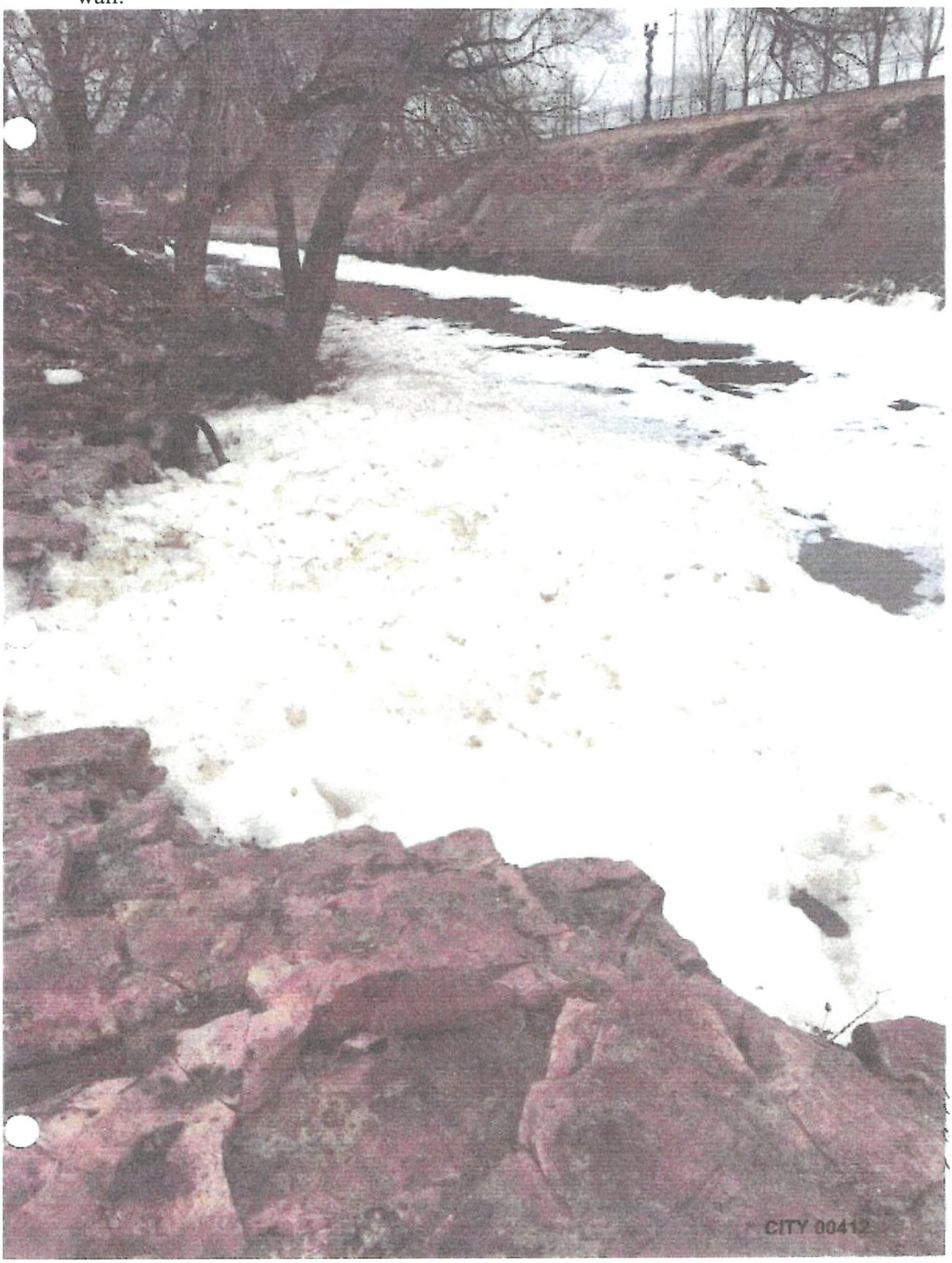


EXHIBIT H. View of falls and river from observation tower (K. Nemire photo #2964).

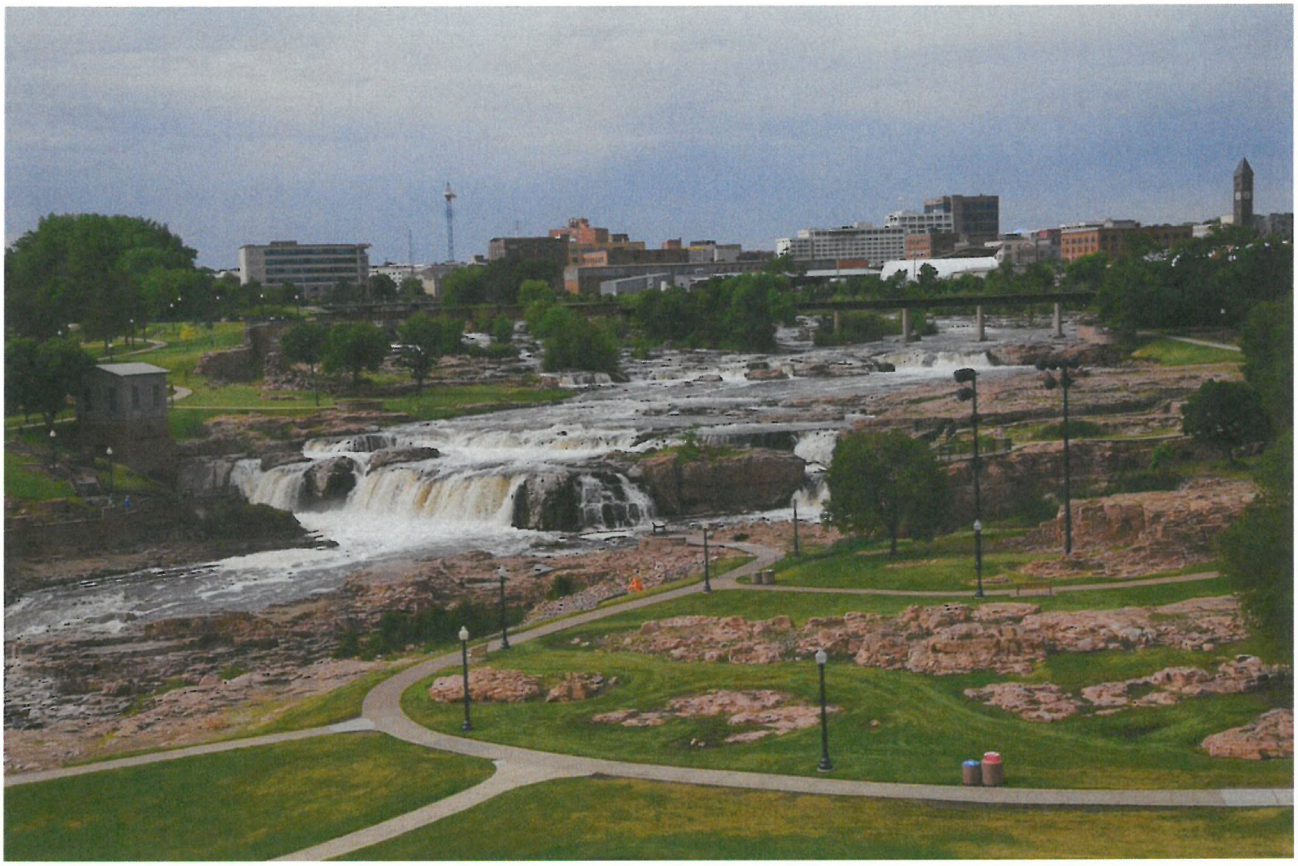


EXHIBIT I. View of falls and river from observation tower (K. Nemire photo #2965).

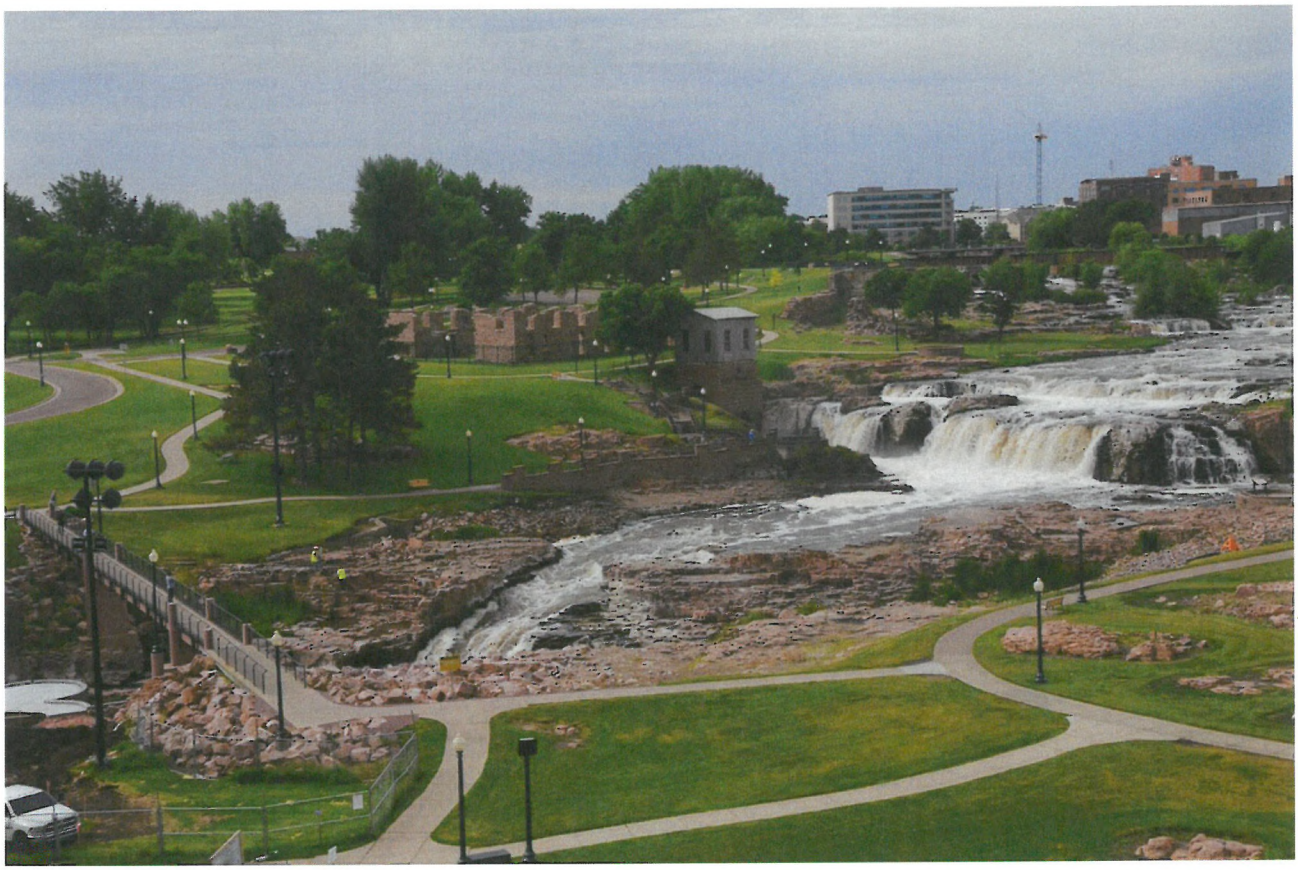


EXHIBIT J. View of falls and river from observation tower (K. Nemire photo #2966).

EXHIBIT K. Photograph taken by City a few hours after Maggie's fall. Note jagged, rocky, canyon wall on other side of river, and that the foam is primarily over the river. Also note that what appears to be snow in the foreground is a different color and texture from the foam on the river.

EXHIBIT L. View of falls and river from location Ms. Jayne and Ms. Melendez were standing when Ms. Melendez took her three produced photos (K. Nemire photo #2990). Note the tall rocky walls of the canyon, and the turbulent waters of the falls and river. This area of the river was not covered in foam on the day of the incident.

EXHIBIT M. View of falls and river from location Ms. Jayne and Ms. Melendez were standing when Ms. Melendez took her three produced photos (K. Nemire photo #2991).Note the tall rocky walls of the canyon, the jagged line of the canyon walls, the uneven surfaces on top of the canyon walls, and the turbulent waters of the falls and river. This area of the river was not covered in foam on the day of the incident.

EXHIBIT N. View of falls and river from location Ms. Jayne and Ms. Melendez were standing when Ms. Melendez took her three produced photos (K. Nemire photo #2992).Note the tall rocky walls of the canyon, the jagged line of the canyon walls, and the uneven surfaces on top of the canyon walls. This area of the river was not covered in foam on the day of the incident.

EXHIBIT O. No fences or warnings at Olmstead View Overlook, Yosemite Park.

EXHIBIT P. No fences or warnings at West Cliff Drive, Santa Cruz, California, overlooking the Pacific Ocean.

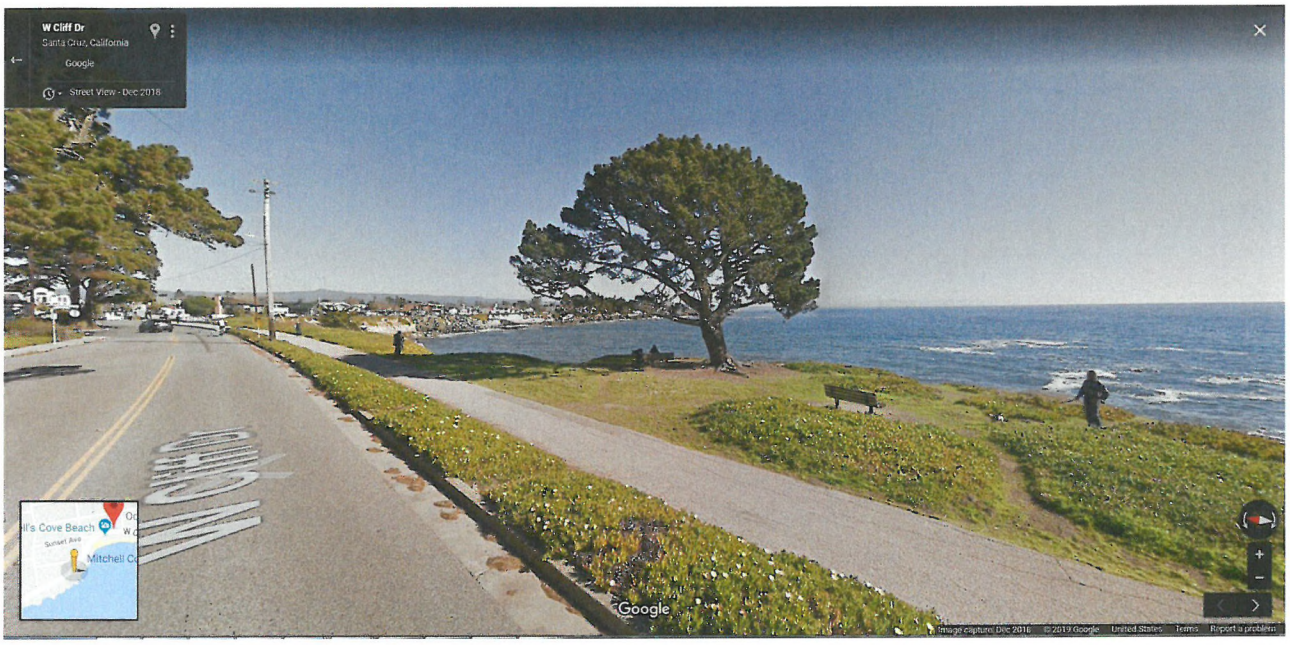
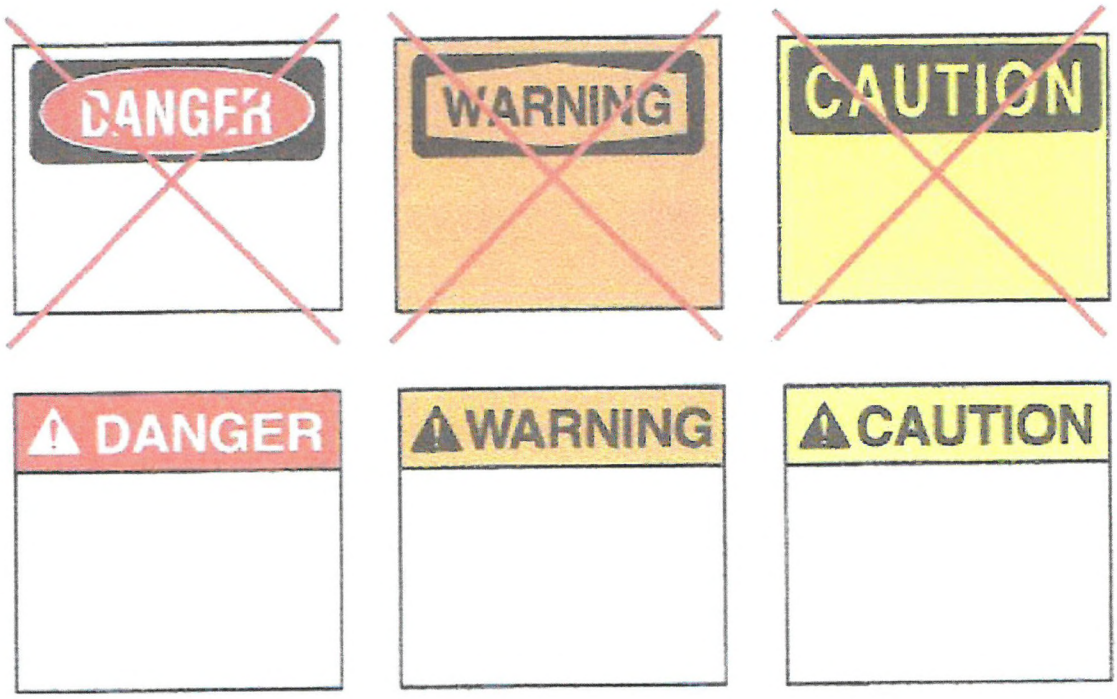


EXHIBIT Q. Warning sign located along the sidewalk connecting the parking lot and the observation tower entrance (K. Nemire photo #2959). Note that the sign presents a prominent feature as one would approach and pass the sign. It would most likely be noticed by most visitors.

EXHIBIT R. The older ANSI Z535 warning format used for the subject sign (top row), which was replaced in 2002 by the newer warning format (bottom row). Given that the signal word in both versions was in all capital letters and with a high contrast visual background, it is not likely that either format would be noticed more than the other (Image from ANSI Z535.1-2011).



COLOR PLATE 10. Old Z35/OSHA safety sign/label formats (top row) replaced in all of the 2002 versions of the Z535 standards with the Z535.4 signal word panel formats (bottom row). (Color version of Chapter 33, Figure 1)

EXHIBIT S. Example adults maintaining close proximity to children, and children maintaining far proximity--at least 10 feet--from river (K. Nemire photo #3018).

EXHIBIT T. Same group as shown in Exhibit S, showing that adult proximity from children and children distance from river was maintained over time. Another group entered this scene, with older children, and they also maintained a safe distance from the river (K. Nemire photo #3020).

EXHIBIT U. While this group remained on the sidewalk and did not venture onto the rocks and near the river, the adults maintained proximity with the younger children by carrying one and holding the hand of another (K. Nemire photo #3067).